

TITLE: Telemetry on a Platter

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~~Secret~~*An extraordinary exchange***Telemetry on a Platter**

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It is Thanksgiving Day 1991 and, instead of feasting on turkey, US interagency specialists are looking at Soviet intercontinental ballistic missile (ICBM) telemetry. Nothing extraordinary about that, as anyone who has worked (b)(1) can attest. But on this day the discussions are occurring at the Soviet processing facility. Soviet specialists are describing the structure of the telemetry signal and the equipment required to extract the data. For those of us who have spent much of our careers collecting, processing, and analyzing Soviet telemetry, such an event was truly the dawning of a new era in the arms control arena.

The Telemetry Protocol

On 31 July 1991, the Strategic Arms Reduction Treaty (START) was signed in Moscow by President Bush and President Gorbachev. Many sections in the treaty dealt with telemetry carried on ICBMs and submarine-launched ballistic missiles (SLBMs). In particular, Article X and the Telemetry Protocol are the major items which address telemetry.

The Telemetry Protocol contains some revolutionary features which will take effect after both sides ratify the treaty. Included among these is the requirement that, following every flight test of an ICBM or SLBM, tapes containing all telemetry data generated on board the missile be provided by the testing party to the observing party. As a prelude to this regular transfer of data, both the US and the USSR are required to conduct a demonstration of the telemetry tapes which they will be providing and of the equipment needed to play back the tapes. The treaty stipulated that these demonstrations occur within 120 days of the treaty signature, which just happened to coincide with Thanksgiving Day, 28 November.

Meeting in Moscow

Early in August 1991, the US and the USSR had agreed to meet in Geneva around 16 September to discuss the details of conducting these demonstrations. These discussions were to be held under the auspices of the Joint Compliance and Inspection Commission (JCIC), which was set up to discuss START topics. Unfortunately, the Soviet coup attempt just before this meeting threw schedules and organizations into chaos. When the Soviets finally focused on organizing the initial meeting of the JCIC, it was late October and little time remained to iron out all the demonstration details. Following a flurry of cables between the US and USSR and a number of "go, no-go" situations, a US team comprised of 12 interagency experts departed for Moscow on 13 November.

Due to the short time remaining before the 28 November deadline, as well as the Soviets' lack of funding authority to purchase *Aeroflot* tickets from Moscow to Geneva, the US had offered to meet in Moscow. This proved to be fortuitous, as a significant number of Soviet telemetry experts were available for direct questioning while the demonstration details were being negotiated. In the past, the Soviets had resisted bringing to Geneva experts knowledgeable in telemetry who could have facilitated discussions. Without the presence of such experts, a meeting in Geneva would have required a substantial amount of time to come to agreement on the very detailed and technical issues being discussed.

Included in the 12-person US team from the Intelligence Community (IC) were (b)(3)(c) Arms Control Intelligence Staff (ACIS); (b)(3)(c) Office of Scientific and

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Scientific Weapons Research (OSWR); (b)(3)(c)
 Office of SIGINT Operations (OSO). The team was led by T. R. Koncher from the Office of the Secretary of Defense, with other representatives from the Joint Chiefs of Staff (JCS), the Department of Energy, the State Department, and the Arms Control and Disarmament Agency.

A Good Beginning

The first meeting was held on 14 November. For the next 10 days, the two sides held intense discussions regarding what each side planned to demonstrate. In order for US policymakers to determine what type of data the US would provide in the future and thus what would be demonstrated, the US team had to assess exactly what the Soviets were planning to demonstrate. This task fell primarily to the IC experts, as only they were knowledgeable of Soviet telemetry and able to understand the information being provided.

Throughout the negotiations the Soviets were cooperative and forthcoming with the level of detail needed. At times, it seemed their experts were flooding us with information, often to the chagrin of the leader of the Soviet delegation.

Finally, an agreement was reached on the details. The US would provide predetection tapes recorded during the missile's flight test and the Soviets would provide a unique postdetection tape. In both cases, these recordings represented the initial level of recording. Because of the delay in initiating the negotiations, it was determined that the US demonstration could occur in late December or early January. (It took place from 13 to 15 January 1992.)

The stage was now set to bring in the rest of the US team to observe the Soviet demonstration. These team members were the "A-team" of recorder, signal-processing hardware, and Soviet telemetry knowledgeable experts; (b)(3)(c) of OSO, and (b)(3)(c) of NSA.

Throughout the planning phase following the July signing and during the negotiations in Moscow, there had always been a level of disagreement and tension

on the US side between the IC and JCS representatives. This was a natural outcome of the conflicting interests of both parties. The IC wanted to obtain the maximum amount of information from the Soviets, which in turn required the JCS to reciprocate with similar information. At times, discussions were heated and contentious within our delegation, but in the end a common path was established.

The A-team

When the A-team arrived in Moscow, the JCS representatives must have thought the shock troops had just hit the shore. These four individuals came with a mission to obtain maximum information and reach a full understanding of the Soviet recording process.

Shivers seemed to emanate from the JCS people as a full realization of the level of detail they would be expected to provide at the US demonstration became apparent. From a counterintelligence perspective, it may all sound as if the IC were ready to give away national secrets. In actuality, all data the US side would provide at its own demonstration were unclassified, and JCS fears were groundless.

Soviet Show and Tell

The demonstration began on 27 November with the US team being escorted to a facility in the town of Kaliningrad, just north of Moscow. This facility is the central location where all ICBM and SLBM telemetry is processed following a flight test.

The demonstration was conducted in the processing laboratory by the people who process the Soviet data. With the lab director, Mr. Kommisarov, setting a tone of complete open-mindedness and cooperation, the demonstrations continued over the course of three days. Though a few problems were encountered, they were all rectified before the demonstrations' completion.

The Soviets provided information on the telemetry hardware used on board their test vehicles. They proudly stated that all their hardware subsystems use

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fourth-generation solid-state electronics having as many as 2,000 discrete elements per solid-state chip.

Three actual components of the onboard telemetry system were handed out for examination. These were the frequency-modulated (FM) transmitter, a dual-ported local code commutator, and a 4-million bit digital storage device used to store and dump test-flight data.

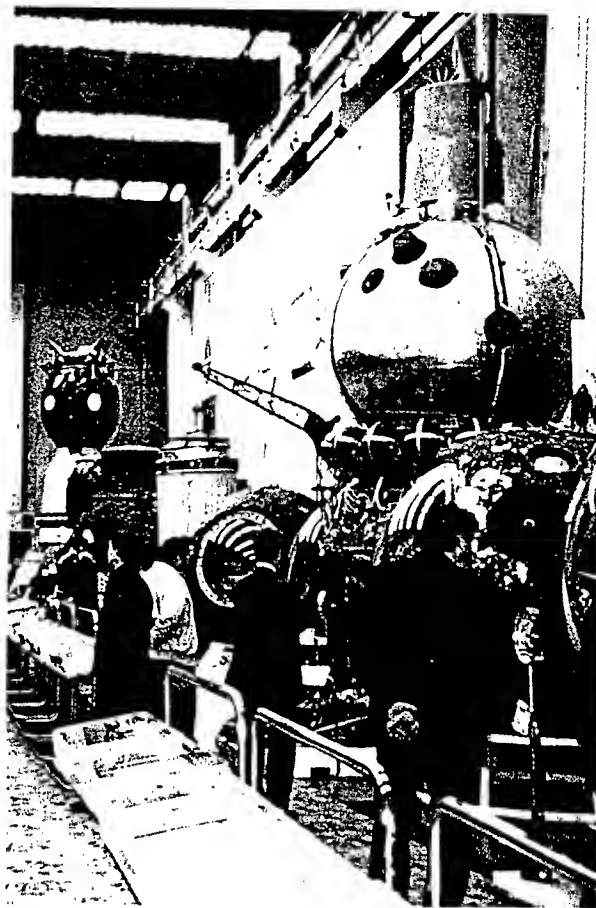
The Soviets demonstrated their proposed methods of disclosing signal decommutation structures, which is called interpretive data in the Telemetry Protocol. This information provides the explicit guide to isolate every unique sensor and/or data word within each complex telemetry signal. The combination of IC intercepted data, the knowledge of Soviet telemetering practices, and the supplementary information derived from the interpretive data should adequately facilitate determining the authenticity of the Soviet-provided data tapes.

The demonstrated Soviet recording equipment was a dual-transport system widely used throughout Soviet missile test ranges for the last 10 years. This analog magnetic storage system can record and play back 24 tracks of digitized data, and it uses tapes which physically conform to US instrumentation standards. Because of the limited sub-megahertz frequency-handling capabilities of the recording equipment, the Soviets record only demodulated signals.

To demonstrate the playback capability of their equipment, the Soviets had generated and recorded a complex simulated telemetry signal. This simulated signal was a generic replica of the signals seen over the years on their ICBMs and SLBMs.

The tape was played back and various displays shown to the US delegation in order to familiarize the US experts with the Soviet recording procedures. The Soviets provided a sample magnetic tape log/summary, which indicated the actual tape format selected, the relative quality of the recording, and other ancillary comments. Such a log will accompany every tape provided in the future.

By the end of the demonstration, the Soviets had satisfactorily shown that their "first recording" is an accurate representation of the transmitted signal.



Visiting the museum.

After completion of the demonstration, this tape was handed over to the US delegation and hand-carried back to the US for analysis.

For those of us in the IC who had devoted much of our careers to Soviet telemetry collection and analysis, this truly was a culmination of years of effort. As is the case these days with many aspects regarding the former Soviet Union, it was difficult to imagine a year ago discussing decommutation structures with the people who designed the system.

Two Side Trips

Besides attending the demonstration, the delegation was treated to side trips to the MIR space-station mission-control center and to the Korolov Design Bureau Museum. At the museum, many space vehi-

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cles are on display, including Gagarin's space capsule. We learned that Gargarin did not actually return to the Earth's surface inside his capsule. He was ejected from the capsule at an altitude of several thousand feet and parachuted to Earth. Following his landing, he was transported to the capsule landing site and photographed inside as if he had been there for the duration of the flight. This was one more bit of new information collected during this most historic venture.

At the close of the demonstration, Mr. Komissarov stated that he was surprised by its rapid progress. He had anticipated that it could take as many as 10 days

to adequately familiarize the US delegation with the Soviet practices. A humorous invitation was extended to a number of the US experts to come to work for him, as his employees had learned a few new things during the demonstration about their own telemetry.

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